ENCLOSURE 2

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

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Licensee:	Entergy Operations, Inc.
Facility:	Waterford Steam Electric Station, Unit 3
Location:	Hwy. 18 Killona, Louisiana
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Attachment 1: Supplemental Information

EXECUTIVE SUMMARY

Waterford Steam Electric Station, Unit 3
NRC Inspection Report 50-382/97-01

This inspection included a review of the licensee's implementation of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," [the Maintenance Rule]. This report covers a 1-week onsite period of inspection.

Operations

- The licensee's operations staff had adequate knowledge to carry out assigned Maintenance Rule responsibilities (Section O4.1).

Maintenance

- The failure to include the containment atmospheric release system into the scope of the Maintenance Rule Program, was a violation of 10 CFR 50.65(b) (Section M1.1).

- The probabilistic risk assessment's level of detail, truncation limits and quality were adequate to perform the risk categorization for the Maintenance Rule Program (Section M1.2).

- The licensee's approach of evaluating the change in core damage frequency for establishing the unavailability performance criteria lacked rigor because the cumulative risk impact of all system interdependencies was not fully evaluated. The overall risk ranking methodology was lacking due to the failure to incorporate the effects of unavailability assumptions in the risk ranking process (Section M1.2).

- The licensee's guidance for performing periodic evaluations lacked specificity to enable implementation (Section M1.3).

- The licensee's method of balancing reliability and unavailability lacked procedural guidance and justification that it would be effective (Section M1.4).

- The method of trending unavailability based on a 24-month rolling average had the potential to mask degrading performance and, therefore, was nonconservative (Section M1.4).

- The licensee's process for the assessment of the safety impact of removing structures, systems, and components from service for monitoring and maintenance was superior to manual methods (Section M1.5).

- There was a potential for failure to identify maintenance-preventable functional failures, because functions were not well defined. The licensee's program did not address which quantitative reference values should be used for the determination of maintenance-preventable functional failures (Section M1.6.b.1).

- There was not a formal process to assure that system engineers performed needed review of changes to the Final Safety Analysis Report, emergency operating procedures, and probabilistic safety analysis models (Section M1.6.b.1).

- The failure to monitor the unavailability of functions associated with the engineered safety features actuation system, plant protection system, core protection calculators, broad range gas monitors, and containment polar crane was a violation of 10 CFR 50.65 (a)(2) (Section M1.6.b.1).

- Industry-wide operating experience was being appropriately considered for the development of performance criteria, goals, and corrective actions to restore structure, system, and component performance (Section M1.6.b.2).

- The manipulation of unavailability trending data was a poor practice that could mask degrading performance (Section M1.6.b.4).

- For those systems in Category (a)(1), the goals established and the corrective actions implemented were adequate to restore performance (Section M1.6.b.4).

- For those systems and equipment that were inspected, material condition appeared good (Section M2).

- The scope of the corporate and third-party assessments of the Maintenance Rule Program was wide-ranging. The identification of issues was thorough, and meaningful feedback was provided to management (Section M7.1).

- Unresolved Item 50-382/9611-02, which dealt with the adequacy of risk assessments performed for unscheduled switchyard maintenance performed in conjunction with the outage of Train B emergency core cooling and containment spray systems, was closed (Section M8.1).

Engineering

- The knowledge and ability of the system engineers to perform their Maintenance Rule Program tasks were adequate (Section E4.1)

Report Details

Summary of Plant Status

During the inspection, the unit was operated at or near full power.

I. Operations

O4 Operator Knowledge and Performance

O4.1 Operator Knowledge of the Maintenance Rule

a. Inspection Scope (62706)

During the inspection, the inspectors interviewed licensed plant operators to determine if they understood the general requirements of the Maintenance Rule and their particular duties and responsibilities for its implementation. The inspectors asked a sample of operators to explain the general requirements of the Maintenance Rule and to describe or demonstrate their responsibilities for implementing these requirements.

b. Observations and Findings

Engineering Guide 459020100, "Maintenance Rule Guideline," Revision 1, was the implementing document for the licensee's program. Step 5.4.4 specified that risk-significant structure, system, and component unavailability would normally be obtained either from the station log, equipment off-normal log, or from data collected for monitoring indicators provided to industry groups. The on-shift reactor operators were responsible for tracking equipment out-of-service time for risk-significant equipment and the senior reactor operators had the responsibility for determining the overall risk associated with emergent work or equipment failures.

The inspectors learned that some reactor operators were unaware that they were responsible for logging all risk-significant equipment out-of-service times in the station log. It was also observed that the equipment off-normal log was not being properly maintained. Numerous entries did not contain restoration dates or times. The inspectors considered these observations to be indicative of poor practices. Licensee representatives were informed of the observations and action was initiated to inform all operators of the necessity to track all risk-significant equipment out-of-service time, and management expectations in this area.

The inspectors determined that the reactor and senior reactor operators had sufficient knowledge of the Maintenance Rule to perform their assigned functions. Overall, the operators were aware of how the Maintenance Rule Program functioned and were able to identify both risk and non-risk-significant systems. All operators were aware of the requirement to evaluate plant risk based on changing equipment unavailability and plant configuration due to equipment failures.

c. Conclusions

The licensee's operations staff had adequate knowledge to carry out assigned Maintenance Rule responsibilities. Operations personnel interviewed were knowledgeable of the equipment out-of-service monitor, the risk meter for emergent work in Mode 1, and the shutdown-risk program used for Modes 5 and 6. However, some operators were not familiar with equipment out-of-service logging requirements.

II. Maintenance

M1 Conduct of Maintenance

M1.1 Scope of the Structure, System, and Component Functions Included Within the Maintenance Rule Program

a. Inspection Scope (62706)

The inspectors reviewed the Waterford 3 scoping to determine if the appropriate structures, systems, and components or related functions were included within the Maintenance Rule Program in accordance with 10 CFR 50.65(b). Licensee representatives provided the inspectors with a list of structures, systems, and components which had been excluded from the scope of the Maintenance Rule Program. The inspectors independently reviewed selected portions of the Waterford 3 Updated Final Safety Analysis Report and emergency operating procedures and identified several excluded structures, systems, and components of functions which appeared to meet one or more of the 10 CFR 50.65(b) scoping criteria. The rationalization for exclusion was discussed in detail with the licensee's representatives.

b. Observations and Findings

The inspectors verified that the licensee had identified the total population of structures, systems, and components available for inclusion in the scope of the Maintenance Rule Program. The numerous sources referenced by the licensee included: the Updated Final Safety Analysis Report, the safety evaluation reports, the design basis documentation, the construction documents, and the extensive station information management system database. The licensee's scoping process was delineated in Section 5.0 of Procedure UNT-006-029, "The

Maintenance Rule," Revision 1. The scoping results were documented in Engineering Guide 459020100, "Maintenance Rule Guideline," Revision 1. The scoping decisions were made at the system level by evaluating the system function against the criteria specified in Section 8.2.1 of NUMARC 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 0.

In accordance with Procedure UNT 006-029, the scoping matrix was prepared and presented to the expert panel for review and approval as the basis for final determination. The inspectors noted that the documentation of the technical bases for some scoping decisions was not always sufficiently detailed. After discussions with members of the licensee's staff, the inspectors concluded that all but one of the justifications were acceptable.

The inspectors found that the containment atmospheric release system had not been placed in the scope of the licensee's Maintenance Rule Program, since July 10, 1996, the effective date of the Maintenance Rule. The licensee's basis for not including this system was that, even though it was safety-related, it did not provide a post-accident safety function, only a mitigating function. The inspectors found this to be an unacceptable justification because 10 CFR 50.65(b) requires safety-related systems to be monitored by the licensee's Maintenance Rule Program. Without monitoring, there was decreased assurance of the performance of the safety-related function upon demand. Therefore, failure to include the system within the scope of the licensee's program was a violation of 10 CFR 50.65(b) (50-382/9701-01).

c. Conclusions

The inspectors concluded that the licensee's scoping effort was generally conservative and thorough, and had resulted in the proper identification of most structures, systems, and components, and their related functions that were required to be within the scope of the Maintenance Rule in accordance with 10 CFR 50.65(b). The failure to include the containment atmospheric release system in scope of the Maintenance Rule Program was a violation of 10 CFR 50.65(b) (50-382/9701-01).

M1.2 Safety or Risk Determination

a. Inspection Scope (62706)

Paragraph (a)(1) of the Maintenance Rule requires that goals be commensurate with safety. Additionally, implementation of the Maintenance Rule using the guidance contained in NUMARC 93-01 requires that safety be taken into account when setting performance criteria and monitoring under paragraph (a)(2) of the

Maintenance Rule. The safety consideration is then used to determine if the structure, system, and component functions should be monitored at the train or plant level. The inspectors reviewed the methods and calculations that the licensee had established for making these required safety determinations. The inspectors also reviewed the safety determinations that were made for the structures, systems, and components that were reviewed in detail during this inspection.

b. Observations and Findings

At the time of the inspection, 42 out of 80 structures, systems, and components within the scope of the Maintenance Rule, were designated as risk-significant. A system or structure was classified as risk-significant if it included a component that was necessary to support a risk-significant function.

The expert panel removed the steam generator blowdown system, which met the criteria of 90 percent core damage frequency cutset contribution. This was because the system was modeled as providing a means to letdown the secondary side of the steam generator following a tube rupture event. However, the expert panel had determined that the primary function of the blowdown system was to equalize pressure across the steam generator and, on that basis, placed the system in the nonrisk-significant category.

The Level 2 portion of the probabilistic risk assessment was used to identify risk-significant structures, systems, and components needed for containment integrity. The expert panel excluded hydrogen recombiners from the risk-significant category because there were default release and dilution methods available to reduce hydrogen concentration.

Within those structures, systems, and components that were in the scope of the Maintenance Rule, the inspectors did not identify any that had been inappropriately ranked. The inspectors determined that the exclusion of the two systems from the risk-significant category was reasonable.

b.1 Risk-Ranking Methodology

The inspectors reviewed a sample of nonrisk-significant structures, systems, and components to assess if the safety significance was adequately established. The inspectors determined that the function modeling in the probabilistic risk assessment for those sampled items was sufficiently detailed. Appropriately, generic data was used to estimate reliability of various component types and failure modes. Specific data was used when statistically sufficient data was available. No Bayesian updating was used. Success criteria for the sampled structures, systems, and components were based on thermal-hydraulic analyses. The inspectors determined that the licensee's representative had not explicitly considered initiating

events in the ranking process, but relied on assigned risk functions for the systems or components. The licensee's representative indicated that initiating events would be directly considered in the ranking process after the probabilistic risk assessment was updated. At the time of inspection, the licensee was updating the probabilistic risk assessment model. The licensee's representative indicated that all changes in the updated probabilistic risk assessment model were considered in the continuous evaluation of risk ranking and scoping of structures, systems, and components for the Maintenance Rule.

The inspectors assessed the truncation limits that were imposed on probabilistic risk assessment models. These limits reduce the size and complexity of calculational results to a manageable level. The licensee used a truncation level of 1E-10 to quantify the probabilistic risk assessment model, five orders of magnitude less than the overall core damage frequency estimate of 1.4E-5 per reactor year. The inspectors considered this value to be adequate for the risk-ranking process.

Based on the sample review of structures, systems, and components, the level of detail, truncation limits, and quality of the licensee's probabilistic risk assessment were adequate to perform the risk ranking required for the Maintenance Rule.

b.2 Performance Criteria

The inspectors reviewed performance criteria to determine if the licensee had adequately set performance criteria and if they were consistent with the assumptions used to establish the safety significance. The licensee elected to use the same reliability performance criteria of no more than one maintenance-preventable functional failure per 24 months for risk-significant structures, systems, and components. No more than 2 maintenance-preventable functional failures per 36 months was selected for reliability performance criteria for nonrisk-significant structures, systems, and components. These selections appeared to preserve the assumptions used in the probabilistic risk assessment. The inspectors found the licensee's reliability performance criteria to be acceptable.

The inspectors noted that unavailability criteria were established for all risk-significant systems and components except: 4.16 kV ac power, 6.9 kV ac power, control element drives, control element drive motor-generator sets, core protection calculator, excore nuclear instrumentation, feedwater, main transformer, process analog control, plant protection, and reactor coolant. The licensee's representative stated that unavailability criteria were not monitored for these systems and components because preventive maintenance or monitoring was not performed during Mode 1 operation.

In general, the unavailability criteria for risk-significant structures, systems, and components were higher than the assumptions used in the probabilistic risk assessment. This was done so that the structure, system, or component

unavailabilities would not exceed performance criteria. The licensee had evaluated the change in core damage frequency for the unavailability performance criterion for each of the risk-significant structures, systems, and components. However, this approach lacked rigor because the cumulative risk impact of all interdependencies was not fully considered, and this type of evaluation would not ensure that the unavailability performance criteria, as a group, were commensurate with safety. Additionally, this type of evaluation could not be used to demonstrate that the risk rankings discussed above would not change because of the given unavailability criteria. In response to this observation, the licensee evaluated the core damage frequency increase when all of the unavailability performance criteria were simultaneously input into the probabilistic risk assessment calculations. The licensee also produced risk-importance calculations to demonstrate that the risk-significance determinations discussed in Section b.1 were not significantly affected. However, the licensee did not have a rigorous method to link performance criteria to the ranking process to ensure the results would not be affected by criteria which were different from the probabilistic risk-assessment assumptions. The inspectors concluded that the overall risk-ranking methodology was lacking because of the failure to incorporate the effects of unavailability assumptions in the risk-ranking process.

The increase in core damage frequency, when all of the unavailability performance criteria were input to the quantification of the probabilistic risk-assessment model, was about 36 percent above the baseline core damage frequency value. The licensee's representative stated that three factors prevented approaching this higher core damage frequency value:

- It was unlikely that all of the risk-significant structures, systems, and components would approach the established unavailability performance criteria simultaneously.

- If the performance criteria were approached in a 2-year period, the probabilistic risk-assessment updating cycle of 18 months to process plant-specific data would result in less risk because a calculated lower core damage frequency would result in more stringent performance criteria.

- Effective Maintenance Rule implementation should result in reduced unavailabilities compared to past performance.

The inspectors agreed that these factors should limit potential core damage frequency increases. However, the inspectors determined that the licensee's approach of establishing the unavailability performance criteria was lacking because the cumulative risk impact of key structures, systems, and components in adverse configurations and their interdependencies were not fully evaluated.

The licensee also did not perform analyses that demonstrated the performance criteria used for reliability preserved the assumptions used in the probabilistic risk assessment. However, the use of reliability performance criterion of no more than one maintenance-preventable functional failure per 24 months for all risk-significant structures, systems, and components appeared to be more stringent than the probabilistic risk-assessment assumptions. In addition, program requirements to evaluate maintenance-preventable functional failure of structures, systems, and components against probabilistic risk-assessment assumptions would ensure that there were no adverse impacts on risk ranking.

b.3 Expert Panel

The licensee's expert panel included members from maintenance engineering, systems engineering, design engineering, maintenance scheduling, operations, maintenance, licensing, and the probabilistic risk-assessment group. In addition to determining which structures, systems, and components were within the scope of the Maintenance Rule, the expert panel established the risk-significance ranking, performance criteria, goals, and the Category (a)(1) and (a)(2) lists of structures, systems, and components. The responsibilities of the expert panel included moving structures, systems, and components from Category (a)(2) status to (a)(1) status and vice versa, and making decisions on balancing of unavailability and reliability. The inspectors found that the expert panel was established in accordance with industry guidance.

The inspectors observed that the licensee's program used quantitative measures of risk-achievement worth, risk-reduction worth, and cutsets contributing to 90 percent of calculated core damage frequency. The final risk-significance ranking was based on a combination of results from the probabilistic risk assessment and expert panel judgment based on their deterministic considerations. The importance measures used for risk ranking were risk-achievement worth, risk-reduction worth, and cutsets contributing to 90 percent of calculated core damage frequency. The inspectors noted that the accident sequence frequencies for dominant sequences in the probabilistic risk-assessment model appeared to be uniformly distributed. Thus, the use of 90 percent core damage frequency cutset contribution as an importance measure would conservatively result in more structures, systems, and components being ranked as risk significant. The expert panel members also indicated that their conclusions on structure, system, or component importance were based on their engineering judgment and using the threshold criterion of any one of the risk-importance measures. The inspectors considered the licensee's expert panel process to be acceptable for implementation of the Maintenance Rule.

c. Conclusions

The probabilistic risk assessment's level of detail, truncation limits, and quality were adequate to perform the risk categorization for implementing the Maintenance Rule requirements. In general, the licensee's proposed performance criteria for unavailability of risk-significant structures, systems, and components were higher than the unavailability assumptions used in the probabilistic risk assessment. These higher unavailabilities did not adversely affect the risk ranking used to establish structure, system, or component safety significance. However, the licensee's approach of evaluating the change in core damage frequency for establishing the unavailability performance criteria lacked rigor because the cumulative risk impact of all system interdependencies was not fully evaluated. The inspectors concluded that the overall risk-ranking methodology was lacking due to the failure to incorporate the effects of unavailability assumptions in the risk-ranking process.

M1.3 Periodic Evaluation

a. Inspection Scope (62706)

Paragraph (a)(3) of the Maintenance Rule requires that performance and condition monitoring activities and associated goals and preventive maintenance activities be evaluated taking into account, where practical, industry-wide operating experience. This evaluation is required to be performed at least one time during each refueling cycle, not to exceed 24 months between evaluations. The inspectors reviewed the plans and procedures the licensee had established to ensure this evaluation would be completed as required, and discussed evaluation plans with the licensee's representative responsible for evaluation performance.

b. Observations and Findings

The inspectors noted that Procedure UNT-006-029, Revision 1, specified that the periodic assessment of maintenance effectiveness to meet the requirements of 10 CFR 50.65(a)(3) would be performed at a frequency not to exceed 3 months after the completion of a refueling outage. The inspectors found that this appeared to meet the requirements.

A licensee representative stated the first periodic assessment was scheduled for July 1997. The inspectors observed that the procedural guidance for performing the periodic assessment was lacking. This was because the inspectors found that the engineering guide was not detailed as to how industry experience would be evaluated, or, how the effectiveness of corrective actions would be evaluated.

The licensee's representative acknowledged the inspectors' findings and indicated that the findings would be addressed prior to the performance of the first required periodic assessment.

c. Conclusions for Periodic Evaluation

No periodic assessment had been required or performed at the time of the inspection. The licensee's guidance for performing periodic evaluations did not contain sufficient detail to enable implementation.

M1.4 Balancing Reliability and Unavailability

a. Inspection Scope (62706)

Paragraph (a)(3) of the Maintenance Rule requires that adjustments be made, where necessary, to assure that the objective of preventing failures through the performance of preventive maintenance is appropriately balanced against the objective of minimizing unavailability due to monitoring or preventive maintenance. The inspectors reviewed the plans and procedures the licensee had established to ensure these objectives were adequately addressed. Discussions were also held with licensee personnel who were responsible for performing the balance evaluation.

b. Observations and Findings

The requirements for balancing reliability and unavailability were discussed in Procedure UNT-006-029, and system engineers were responsible for the balancing evaluation on a monthly basis.

The licensee had established unavailability criteria to limit the increase in core damage frequency to 25 percent. The licensee's approach for balancing unavailability and reliability consisted of monitoring performance against the established performance criteria. The process considered that a balance was achieved if the performance criteria were met. As stated earlier, the approach in establishing unavailability performance criteria lacked rigor. Thus, the approach used for determination of proper balance between reliability and unavailability was potentially nonconservative.

For the structures, systems, and components reviewed, system engineers were collecting the out-of-service times to determine unavailability to monitor against performance criteria and to evaluate the balancing of reliability and unavailability. Unavailability data were monitored, analyzed, and trended for monthly performance on a 24-month rolling average. The inspectors questioned the use of "rolling average data" for monitoring unavailability instead of determining where the performance criteria over a 24-month period were exceeded. The licensee's approach had the potential to mask increased unavailability data near the end of the 24-month monitoring period or make performance degradation more difficult to detect.

Normally, the use of maintenance-preventable functional failures would not give sufficient information about structure, system, or component reliability performance. Meaningful estimates of reliability require information about the structure, system, or component demands and time-in-service. However, the licensee's conservative criteria for reliability and stringent program requirements for evaluation of failures compensated for this nonrigorous practice, but did not provide an adequate means to evaluate the balance-of-reliability and availability.

c. Conclusions for Balancing Reliability and Unavailability

The inspectors concluded that the licensee's method of balancing reliability and unavailability lacked procedural guidance and justification that it would be effective. The method of trending unavailability based on a 24-month rolling average was nonconservative.

M1.5 Plant Safety Assessments Before Taking Equipment Out-of-Service

a. Inspection Scope (62706)

Paragraph (a)(3) of the Maintenance Rule states that the total impact of maintenance activities on plant safety should be taken into account before taking equipment out-of-service for monitoring or preventive maintenance. The inspectors reviewed the licensee's procedures and discussed the process with the Maintenance Rule coordinator, the reliability engineers, the expert panel members, plant operators, system schedulers, and work week supervisors.

b. Observations and Findings

The licensee imposed the requirement to assess the impact on plant safety when removing equipment from service through corporate policy. The policy stated that qualitative and quantitative reviews were required on proposed work schedules to verify that the scheduled activities did not present unacceptable risk to either personnel or plant safety. Administrative Procedure PLG-009-007, "Routine Scheduling of Station Activities," Revision 4, addressed the process for considering safety impact of on-line maintenance activities. This procedure provided guidance on qualitative and quantitative analyses of risk impact on the plant when removing equipment from service. Quantitative analysis of risk associated with on-line maintenance activities was accomplished using the equipment out-of-service monitor, which was a software code for calculating core damage frequency estimates of equipment outage configurations. Administrative Procedure PLG-009-014, "Conduct of Planned Outages," Revision 2, provided guidance for evaluating shutdown risk during plant refueling outages.

In September 1996, the equipment out-of-service monitor was installed in the control room as an advisory tool for operations personnel to evaluate the risk impact of changing plant configuration to support maintenance. The familiarity and use of the equipment out-of-service monitor were part of required initial and continuing training for senior reactor operators and shift technical advisors. The equipment out-of-service monitor in concert with Administrative Procedure PLG-009-007 provided backshift operations personnel with a method to assess the change in risk associated with emergent work or equipment failure, and determine if ongoing tasks should be postponed.

The equipment out-of-service monitor used four risk levels of green, yellow, orange, and, red, ranging from a baseline Plant Safety Index of 10 to zero, to identify safety impact. The orange condition indicated high risk level and senior management approval was required before voluntarily entering into the condition. Voluntary entry into the red condition was prohibited. Interviews with various operations staff personnel reflected a conservative approach to the removal of equipment from service during power operation.

The inspectors noted that a truncation level of 1E-7 was used in the equipment out-of-service monitor to speed up the risk calculations of various configurations. Additionally, the probabilistic risk assessment model implemented in the equipment out-of-service monitor was modularized such that single basic events on the same train were modularized into a supercomponent event, and each calculation was a full requantification of the risk model.

The inspectors interviewed scheduling personnel to evaluate the process of assessing risk associated with the maintenance work activities scheduled in the 12-week rolling schedule. Equipment out-of-service monitor risk assessments on the scheduled activities (frozen 10 days prior to the work implementation week) were provided to work week supervisors for making decisions on changes to the work schedule if high risk configurations were encountered. A licensee representative indicated that the probabilistic risk assessment group would be requested to validate equipment out-of-service calculations to assure consistency and adequacy of the risk results for scheduling plant activities. The licensee also used the outage risk assessment management code to evaluate the risk of plant configurations during outages.

The inspectors reviewed the control room operator logs to identify risk-significant "time windows" in which several structures, systems, and components were concurrently out-of-service. The inspectors identified time windows on September 4, December 4 and 5, 1996, where four or more structures, systems, or components were out-of-service concurrently. The licensee performed risk-profile calculations of the identified equipment-outage configurations using the equipment out-of-service monitor. The equipment-outage configuration on December 4, 1996, involving Technical Specification-required surveillance on the Component Cooling Fans 10A, 11A, and 12A, and Auxiliary Component Cooling Water Pump A,

resulted in an index value of 8.1 (orange condition). However, the duration of the outage configuration was only 1/2 hour. The inspectors determined that there was no unacceptable risk due to changed configurations during the sampled time periods.

c. Conclusions for Safety Assessments

The inspectors determined that the licensee's process for the assessment of the safety impact of removing structures, systems, and components from service for monitoring and preventive maintenance was superior to manual and qualitative methods.

M1.6 Performance Criteria, Monitoring, and Preventive Maintenance

a. Inspection Scope (62706) (62002)

The inspectors reviewed program documents and records to evaluate the process that had been established to set goals and monitor in accordance with the requirements of paragraph (a)(1) and to verify that preventive maintenance was effective in accordance with the requirements of paragraph (a)(2) of the Maintenance Rule. The inspectors also discussed the program with the Maintenance Rule coordinator, system engineers, plant operators, and schedulers.

The inspectors reviewed the systems described below to verify that goals or performance criteria were established with safety taken into consideration; that industry-wide operating experience was considered, where practical; that appropriate monitoring and trending was being performed; and that appropriate corrective action was taken when a structure, system, or component failed to meet its goal or performance criteria or experienced a maintenance-preventable functional failure.

b. Observations and Findings

b.1 Safety Consideration in Setting Performance Criteria for Category (a)(2) Monitoring

The Maintenance Rule, as implemented using the guidance in NUMARC 93-01, requires that safety (risk) be taken into consideration when establishing goals under Category (a)(1) or performance criteria under Category (a)(2).

The licensee had 14 systems classified in Category (a)(1). There were no structures identified as being in Category (a)(1). All of the systems performed risk-significant functions. The licensee did not classify any structure, system, or component functions as run-to-failure or inherently reliable. The number of systems being addressed in Category (a)(1) indicated that the licensee was conservative in

evaluating system performance. The inspectors reviewed the licensee's Maintenance Rule Program for structures and the sampled systems against regulatory and industry guidance for compliance with the Maintenance Rule.

(1) Structures

The licensee had not completed the implementation of the program for monitoring structures. The process was described in Engineering Guide 459020100, "Maintenance Rule Guideline," Revision 1, and Design Engineering Guide CIV-A-002, "Maintenance Rule Structural Monitoring," Revision 0. The inspectors evaluated the licensee scoping criteria, condition monitoring criteria, and periodic inspection schedule for monitoring individual structures.

The total population of site structures had been identified and program scoping criteria had been applied to identify those structures in the scope of the program. Those structures determined to be in scope were being subjected to a condition monitoring program based on baseline and periodic inspection results. The structures would be placed in Category (a)(1) or (a)(2) dependent on meeting acceptability criteria defined in the program. Placing a structure in Category (a)(1) required action by the licensee's expert panel and approval by the reliability improvement team.

The licensee's Maintenance Rule structure monitoring program could not be implemented until the structure baseline inspections were complete and existing discrepancies were identified for all in-scope structures. Implementation would be required when Regulatory Guide 1.160, Revision 2 was issued. The inspectors concluded that the licensee's program, once implemented, should be adequate for monitoring the effectiveness of maintenance activities on appropriate site structures as required by 10 CFR 50.65.

The inspectors found that, while cranes were considered to be within the scope of the structures that housed them, the function of lifting heavy loads over safety-related equipment was not monitored by the licensee's Maintenance Rule Program. Since July 10, 1996, the licensee had only monitored structural functions with respect to the cranes and did not monitor at the plant, system, or component level, crane functions associated with the safe lifting of heavy loads. Failure to monitor those functions related to lifting loads did not provide high assurance of the success of those functions. The inspectors found this to be in contrast to the Maintenance Rule in that the failure of the containment polar crane while lifting heavy loads over safety-related equipment could result in the prevention of equipment from fulfilling safety-related functions, or in the actuation of

safety-related systems. Therefore, failure to adequately monitor and assure the important functional performance of lifting heavy loads of the containment polar crane was a violation of 10 CFR 50.65(a)(2) (50-382/9701-02).

(2) Category (a)(2) Monitored Systems with No Issues

The inspectors sampled systems monitored under Category (a)(2) that met all program requirements. For the systems listed below, performance was monitored satisfactorily. The selected monitoring criteria addressed safety considerations and regulatory requirements were met.

- Low pressure safety injection
- High pressure safety injection
- Emergency feedwater
- Feedwater

(3) 4160 Volt Electrical Power Distribution System

The 4160 volt electrical power distribution system was risk-significant and was monitored under Category (a)(2) using train-level reliability performance criteria. One maintenance-preventable functional failure was identified in the licensee's historical review. The system was not monitored for unavailability because the on-line periodic or preventive maintenance performed had not rendered the system unavailable during operation. The licensee's justification for not monitoring system unavailability was reasonable.

The inspectors noted the Maintenance Rule database did not identify all the functions listed in the Final Safety Analysis Report Chapter 8.1.4.2. Functions, such as providing independent, redundant, or testable power under accident conditions were not listed in the database. This observation was also noted on other systems.

The inspectors noted confusing quantitative functional parameter limits to be used for determining if a maintenance-preventable functional failure had occurred in the 4160 volt circuit breaker's under voltage trip function. The Final Safety Analysis Report and the surveillance test procedure stated to use 3307 volts, but the Technical Specifications stated to use 3245 volts. The licensee's program did not address which was used to identify a maintenance-preventable functional failure. The inspectors made similar observations on other systems.

The inspectors believed that there was not a formal process in place to assure that system engineers reviewed changes to the Final Safety Analysis Report, emergency operating procedures, and probabilistic safety analysis models as required by Engineering Guide 459020100, Section 4.2.2. Some engineers had not seen material that they should have reviewed.

(4) Containment Spray System

Containment spray was a risk-significant standby system that was monitored under Category (a)(2) using train-level performance criteria of reliability and unavailability per year within a 24-month rolling average. The licensee's historical review did not identify any maintenance-preventable functional failures.

The inspectors reviewed Corrective Action Document CR-95-1165, which was initiated when Valve CS-118A, "Recirculation Line Isolation Valve," was determined to be binding during closing and, consequently, was not fully shut as required for the testing lineup. The licensee identified this as a personnel error when it was recognized that the valve was in the incorrect position. This was not identified as a maintenance-preventable functional failure during the historical review. However, it is the NRC's position that personnel errors committed in support of maintenance, surveillance, or testing activities should be considered for classification as maintenance-preventable functional failures. The impact of this failure was of no consequence because the failure would not have resulted in placing the system in Category (a)(1). The error in question was documented in Licensee Event Report 96-012 where the root cause and corrective actions were identified. The failure to close this valve as required was also the subject of enforcement initiated as a result of findings in NRC Inspection Report 50-382/96-20.

The inspectors noted that the system minimum flow requirement in the design basis document and the Final Safety Analysis Report (1810 gpm) was different from the test procedure (2000 gpm). This was another example of an unclear quantitative functional limit.

The inspectors found the performance criteria were reasonable and commensurate with safety.

(5) Plant Protection System

The plant protection system was designated as risk significant, with operating and standby functions. The licensee's historical review identified five maintenance-preventable functional failures. Four of the failures were repetitive and had occurred prior to 1994. Because of this history, the system was placed in Category (a)(1) at the time the licensee implemented

the Maintenance Rule. There were no additional maintenance-preventable functional failures over the 2-year period prior to Maintenance Rule implementation. Because of this, the licensee considered the corrective actions to have been effective; thus, the system had been subsequently moved into Category (a)(2).

The performance criterion established for the plant protection system was no more than one maintenance-preventable functional failure per 2-year period. The inspectors noted that the plant protection system was not being monitored for unavailability. The inspectors also noted that the core protection calculators were not being monitored for unavailability. The licensee's position was that monitoring unavailability of these systems was not required based on the coincidence property (2 out of 4) inherent in the systems' design. It was further stated that even though trains may be taken out-of-service, the risk associated with these systems does not change. Therefore, keeping track of maintenance-preventable functional failures is sufficient to assess the overall performance of these systems.

The inspectors did not consider this position to meet the intent of the Maintenance Rule. Maintenance-preventable functional failures are a subset of functional failures which would contribute to unavailability. Additionally, the balance between reliability and unavailability due to preventive maintenance and surveillance could not be assessed as required by 10 CFR 50.65(a)(3).

The failure to monitor the unavailability of functions associated with the plant protection system and core protection calculators was a violation of 10 CFR 50.65 (a)(2) (50-382/9701-02).

(6) Engineered Safety Features Actuation System

The engineered safety features actuation system was considered a standby risk-significant system. The licensee's historical review did not identify any functional failures. Therefore, the system was initially placed in Category (a)(2). The inspectors' review of engineered safety features actuation system condition indication reports and condition reports back through 1994 did not identify any functional failures.

The inspectors noted during a review of the System Engineer Maintenance Rule Notebook for the engineered safety features actuation system that, similar to the plant protection system, reliability criteria had been established as no more than one maintenance-preventable functional failure per 2 years. The system unavailability was not being monitored for the same reason that

the licensee did not monitor unavailability of the plant protection system. The inspectors did not consider this practice to meet the intent of the Maintenance Rule, as the Maintenance Rule requires monitoring the effectiveness of corrective and preventive maintenance.

The failure to monitor the unavailability of the engineered safety features actuation system is another example of Violation 50-382/9701-02, which is discussed above.

b.2 Use of Industry-Wide Operating Experience

The Maintenance Rule, as implemented using the guidance in NUMARC 93-01, requires that industry-wide operating experience be taken into consideration, where practical, when establishing goals under Category (a)(1) or performance criteria under Category (a)(2).

The inspectors determined that industry operating experience was considered by the expert panel when performance criteria were initially developed. Additionally, all industry operating experience was available to the system engineers through a comprehensive onsite program. The system engineers were responsible for establishing goals when equipment entered Category (a)(1). Industry experience was reviewed and factored into the goals developed by recovery plans.

b.3 Monitoring and Trending

The statements of consideration for the Maintenance Rule indicated that, where failures are likely to cause loss of an intended function, monitoring should be predictive in nature providing early warning of degradation. The licensee had assigned the responsibility for trending and evaluating the performance of Maintenance Rule-related functions to the system engineers. All system engineers trended unavailability when it was monitored. Reliability, was not trended due to the low criteria of no more than one maintenance-preventable functional failure for risk-significant structures, systems, and components. Unavailability was trended on a 24-month rolling average. The inspectors considered this practice to be nonconservative as noted in Section M1.4.

During a walkdown of the emergency feedwater system, the inspectors identified that Valve EFW-224B was on increased frequency inservice testing (alert range) and the system engineer was not aware of this. A licensee representative indicated that this was not considered as a degraded adverse trend since the valve was recently placed (January 6, 1997) on increased monitoring. The inspectors agreed with this distinction.

b.4 Safety Considerations and Adequacy of Performance Criteria, Goals, and Corrective Actions for Category (a)(1) Monitoring

The inspectors reviewed the licensee's process and procedures for establishing corrective actions. The inspectors then reviewed the performance criteria, adequacy of licensee-established goals, and the adequacy of corrective actions to attain the goals for those systems designated as Category (a)(1) by the licensee's program. The maintenance or system engineers who had primary responsibility for performing root-cause determinations and establishing corrective actions were interviewed. The results of interviews and document reviews for those Category (a)(1) systems are described below.

(1) Auxiliary Feedwater System

Auxiliary feedwater was designated a risk-significant standby system normally monitored using performance criteria for reliability and unavailability. The system was being monitored under Category (a)(1). The reliability and unavailability criteria were no more than one maintenance-preventable functional failure and less than 200 hours, respectively, over a 2-year period. The licensee's historical review identified only one maintenance-preventable functional failure. The current unavailability was in excess of 800 hours per year.

When the licensee determined that the unavailability limit of 200 hours was exceeded, Condition Report CR-96-0782 was written and root-cause analysis performed. The cause was determined to be a personnel error during calibration of the pump motor over current protection relay. This occurred when a blocking device was left in place after the procedure had been completed. The goal was to achieve less than 40 hours of unavailability in the third quarter of 1996, which was accomplished. The corrective action was to review recent electrical maintenance work orders for similar occurrences, which was in process.

The station information management system and the Final Safety Analysis Report did not include a piping line from the steam generator blowdown to the condenser. However, the design basis document and the system description did include this piping line. There were components in this piping line which could fail and not be identified as a failure within the system because of confusion about the boundaries. The inspectors determined there was a lack of guidance on defining the Maintenance Rule boundaries of a system in the licensee's program.

The inspectors found the performance criteria were reasonable and commensurate with safety. The cause evaluation, corrective action, and established goals were commensurate with safety and adequate to restore system performance.

(2) Chilled Water System

Chilled water was designated as a risk-significant system monitored using performance criteria for reliability and unavailability. The system was monitored under Category (a)(1). The unavailability and reliability criteria were 100 hours per year and no more than one maintenance-preventable functional failure over a 2-year period. The licensee's historical review had identified three maintenance-preventable functional failures. The current unavailability performance met the criterion.

The licensee's historical review established that this system had exceeded it reliability criterion with three maintenance-preventable functional failures during the period reviewed. Two of the failures affected the refrigerant side of the system. The third failure was on the chilled water side of the system. The system was placed in Category (a)(1) due to the failures. Subsequently, the system was redesignated as separate refrigerant and chilled water systems. The refrigerant system was left in Category (a)(1) because of the two previous failures. The chilled water system was conservatively placed in Category (a)(1) when the systems became separate. Condition Report 96-0686 was written and a root-cause analysis performed. The analysis revealed that improper water chemistry conditions caused the heat exchanger fouling. A goal was established to achieve and maintain acceptable system water chemistry conditions. The corrective action was to flush and chemically treat the system, and then rebalance the system flow. The corrective actions were in progress.

The performance criteria were adequate and commensurate with safety. The established goal and corrective actions were adequate and commensurate with safety.

(3) Instrument Air System

The normally operating instrument air system was designated as risk significant and was in Category (a)(1). The functions of this system were; (1) to provide storage of air to operate safety related valves, and (2) to supply control air to the steam bypass control system valves. The system was monitored using reliability and unavailability criteria. The system was placed in Category (a)(1) when both trains exceeded the system unavailability performance criteria of 200 hours per year per train.

The unavailability criteria were exceeded when the compressor motors in each train were unavailable for many hours to correct motor bearing oil leakage. Apparently, a major portion of the excessive unavailability hours occurred because the compressor motors were sent offsite to a vendor for bearing repair. During the current 2-year monitoring period, the system had experienced two functional failures, but neither failure was maintenance

preventable. Compressors A and B had exceeded the unavailability performance criteria with 854 and 235 hours, respectively. The inspectors reviewed the goals to reduce Compressor A unavailability to less than 40 hours per quarter and to meet the performance criteria established for both trains. The licensee implemented corrective action to closely monitor Compressor A bearing leakage, initiate procurement action for a spare compressor motor, and to monitor and trend compressor unavailability. The inspectors reviewed corrective maintenance and corrective action data going back 2 years and identified no additional functional failures.

The performance criteria were adequate and commensurate with safety. The inspectors found the established goals to be reasonable and commensurate with safety. The planned corrective action was adequate to meet the goals and restore performance.

(4) Main Steam System

The normally operating main steam system, had five Maintenance Rule functions. Of the five functions, three were considered risk significant and monitored using reliability and availability. Two were nonrisk significant and monitored at the plant level.

The system was placed in Category (a)(1) when the reliability performance criteria of no more than one maintenance-preventable function failure per 2-year period, was exceeded. According to the licensee's database, over the past 2 years, the main steam system had experienced 11 functional failures, of which 6 were maintenance preventable. The system had exceeded the 72 hour per train unavailability criteria. The failures were attributed to Atmospheric Dump Valves A and B resulting in unavailability of 137 and 180 hours, respectively.

The inspectors reviewed corrective maintenance historical data and problem evaluation requests for a 2-year period. No additional functional failures were identified during the review.

The identification of maintenance-preventable functional failures for the atmospheric dump valves was based on results from the inservice testing program. The inspectors noted that the licensee had recently changed definitions for atmospheric dump valve functional failures and unavailability. The licensee considered that inservice testing results did not realistically reflect the Maintenance Rule functional capabilities of the valves. Atmospheric dump valve functional failures were defined as: (1) the inadvertent opening of a valve, (2) failure of a valve to open to a position greater than 50 percent within 1 minute on a 100 percent open demand signal, and (3) failure of a valve to close within 5 minutes on a full closure signal. Unavailability of a valve was defined as when the valve was unable

to operate pneumatically. The licensee had also determined that unavailability would not accrue when a valve was isolated (provided that the valve could be operated pneumatically to perform its system function and a functional failure had not occurred). The definition of unavailability was considered acceptable because the assumptions for cooling down the reactor using the atmospheric dump valves were based on an allowance of 30 minutes after an event until cooldown was to be implemented.

The inspectors reviewed the goals established for the main steam system atmospheric dump valves. The goals were to: (1) reduce atmospheric dump valve unavailability to less than 50 hours per year over a 24-month rolling average, and (2) pass six monthly inservice testing program stroke tests.

The licensee intended to reevaluate condition reports issued during the current monitoring period against the new definitions of atmospheric dump valve and steam bypass system functional failures. A reduction in the number of currently identified main steam maintenance-preventable functional failures might result from review.

The performance criteria were adequate and commensurate with safety. The inspectors determined the new definitions for reliability and unavailability were adequate and commensurate with safety. The goals were considered adequate to attain the desired performance.

(5) Control Room Envelope Ventilation System

In implementing the Maintenance Rule, the licensee divided the control room heating, ventilation, and air conditioning system into two systems consisting of the temperature control and the envelope aspects. The control room envelope system was designated a risk-significant system. System performance was monitored using train unavailability and a system-level reliability criterion based on maintenance-preventable functional failures.

The control room envelope system was classified in Category (a)(1) due mainly to excessive simultaneous unavailability of both broad range gas monitors. In addition, system unavailability time increased when Door 71 had numerous problems with an undersized latch that failed and required repair. One maintenance-preventable functional failure was identified for failure to obtain work authorization prior to removing the latch for Door 71, which rendered the envelope inoperable. No other maintenance-preventable functional failures were identified.

The inspectors noted that unavailability for the broad range gas monitors was not monitored and tracked. The broad range gas monitors provided train isolation signals for the control room on detection of toxic chemicals. Also, the licensee did not consider the broad range gas monitors unavailable

when the monitors were taken out-of-service because the control room was placed in an isolated condition and the isolation actuation function was not needed. Additionally, when a single train was taken out-of-service, the licensee considered the function to be available and did not count the monitor as unavailable. Therefore, failure to monitor train component unavailability did not meet the intent of Maintenance Rule because the effectiveness of the broad range gas monitor preventive maintenance program was not being evaluated. This was identified as another example of a violation of 10 CFR 50.65 (a)(2) (50-382/9701-02).

The licensee-established goals to replace the broad range gas monitors and the locking mechanism for Door 71. The plan required the components to be replaced and pass acceptance testing.

The licensee-established performance criteria were not adequate to monitor the effectiveness of maintenance. The goal of replacing the monitor and door lock appeared adequate to address the performance concerns and were commensurate with safety.

(6) Cable Vault and Switchgear Heating, Ventilation, and Air Conditioning System

The cable vault and switchgear heating, ventilation, and air conditioning system and its associated functions were designated as risk significant. The system was placed in Category (a)(1) when the system exceeded its unavailability hours for Fan AH-25(B). System performance was monitored using component unavailability and system-level reliability criteria based on maintenance-preventable functional failures. The licensee had not identified any maintenance-preventable functional failures.

The inspectors reviewed the recovery plan and found it to contain appropriate goals to ensure maintenance effectiveness was improving prior to returning the system to Category (a)(2). An administrative 72-hour unavailability limit was instituted for the system. During the review of unavailability trending on the system, the inspectors noted a prompt decrease in unavailability hours during August to September 1996. Engineering Guide 459020100, Step 5.4.8, recommended that unavailability should be reported with hours per year units and should span 2 years of data. The system engineer indicated the large decrease (below Category (a)(2) unavailability limits) was due to reducing the rolling average period from 24 to 18 months. This averaging technique was done to put the system below the unavailability limits and return it to Category (a)(2); however, the system remained in Category (a)(1). This technique was utilized to remove data that the licensee considered faulty from the 24-month rolling average trend. This reduction in the rolling average was approved by the reliability improvement team which had responsibility for approving all

reclassification from Category (a)(1) to Category (a)(2). The inspectors determined that this manipulation of unavailability trending data was a poor practice that could mask adverse performance.

The inspectors concluded that the performance criteria were reasonable and set commensurate with safety. The goals to address the unavailability performance problem were reasonable and commensurate with safety. The manipulation of unavailability trending data was a poor practice that could mask adverse performance.

(7) Component Cooling Water System

The component cooling water system was designated as risk significant, with both operating and standby mode functions. System performance was monitored using reliability and unavailability criteria of no more than one maintenance-preventable functional failure and 100 hours per year unavailability on a 24-month rolling average, respectively. The licensee's historical review of the system identified several maintenance-preventable functional failures. Therefore, the system was placed in Category (a)(1) prior to Maintenance Rule implementation.

Condition Report CR-96-0869 was initiated in June 1996 to identify corrective actions and establish a component cooling water system recovery plan with specified goals and monitoring requirements. Subsequent to implementation of the Maintenance Rule, two additional unrelated maintenance-preventable functional failures occurred. The first failure (documented in Condition Report CR-96-1315) dealt with 215 ml of an incorrect type of oil that was added to Component Cooling Water Pump A. This caused the pump to be declared inoperable. The second failure (documented in Condition Report CR-96-1547) involved severe corrosion of the accumulators for two component cooling water system air-operated valves. The cause was determined to be lack of a program to maintain equipment coatings.

These two issues were incorporated into existing Condition Report CR-96-0869, along with their respective corrective actions and goals to measure the effectiveness of the corrective actions.

The corrective actions were completed and included immediate replacement of the incorrect oil type, performance of a pump operability test, determination that there were no long-term effects, and counseling of the responsible individual. The goal was that human performance errors would not result in the addition of an incorrect type of oil to any component for a period of one calendar quarter. The in-house events analysis group was assigned to identify repeat incidents of adding incorrect oil to equipment.

The corrective actions established for the accumulator corrosion issue included immediate replacement of one of the accumulators, initiation of actions to replace the accumulators with material suitable for their corrosive environment, establishment of repetitive tasks to periodically paint safety-related equipment located in the wet cooling tower areas, and approval of a design change to eliminate wet cooling tower overspray (during Refueling Outage 9 which is scheduled for September 1998). The goal was to have no failures of safety-related equipment in the wet cooling tower areas due to inadequate coating for 1 year. The in-house events analysis group was assigned responsibility for identifying incidents of equipment failure due to inadequate coating maintenance.

The inspectors observed, and discussed with licensee personnel, that the system functions were broad based and did not always effectively quantify or provide criteria or parameter values for measuring functional performance. The inspectors noted that the System Engineer Maintenance Rule Notebook defined unavailability as when a loop was not supplied by a component cooling water pump, when a component cooling water pump was not available for use, or when a dry cooling tower did not meet the limiting conditions for operation as specified in Technical Specification 3.7.4. Yet, the Notebook defined a functional failure as any failure which prevented a train from performing a defined system function. The inspectors were concerned that the unavailability description had the potential for limiting or restricting the data to be considered for the determination of unavailability (i.e., not considering components such as valves that might fail and, thus, prevent a train from performing a system function).

The inspectors noted an inconsistency with respect to Maintenance Rule performance criteria. The System Engineer Maintenance Rule Notebook showed that reliability acceptance criteria had been established as no more than one maintenance-preventable functional failure per 2 years. However, the recovery plan addressed performance criteria as being two or less maintenance-preventable functional failures during a 24-month rolling average. The system engineer acknowledged the inconsistency and stated that this would be evaluated and corrected.

The inspectors also observed conflicting guidance for trending unavailability. Section 5.4.8 in Engineering Guide 459020100, "Maintenance Rule Guideline," Revision 1, stated that unavailability data should be reported with hours per year per unit and should span 2 years of data (2-year rolling average), and it should be documented in the System Engineer Maintenance Rule Notebook. The inspectors noticed an inconsistency in application of this methodology during review of the unavailability data in the System Engineer Maintenance Rule Notebook. Specifically, the component cooling water system trend data matrix showed that the data had been trended on an annual limit of 100 hours on a 24-month rolling average.

Except for the questions regarding broad functional descriptions, inconsistency in defining Maintenance Rule performance criteria, and potential for limiting unavailability determination, the inspectors found that reliability and unavailability performance was being adequately monitored. Additionally, corrective actions were adequate to achieve improved performance and goals were reasonable and commensurate with safety.

(8) Auxiliary Component Cooling Water System

The auxiliary component cooling water system was designated risk significant, with both operating and standby mode functions. The system was monitored against reliability and unavailability criteria of no more than one maintenance-preventable functional failure and less than 100 hours per year on a 24-month rolling average, respectively. The licensee's historical review of the system's performance indicated that the system exceeded reliability performance criteria due to three maintenance-preventable functional failures. Therefore, the system was placed in Category (a)(1) prior to Maintenance Rule implementation.

Condition Report CR-96-0868 was initiated on June 3, 1996, to document corrective actions and goals for the three failures. Subsequent to the implementation of the Maintenance Rule, further licensee review identified an additional maintenance-preventable functional failure reported in Condition Report CR-96-0729. Therefore, all four identified failures were included in new Condition Report CR-96-1547.

The first failure dealt with a valve that did not immediately respond to a close signal. Cause analysis found the problem was attributable to a failure to replace elastomer O-ring seals. The second failure involved Wet Cooling Tower Fan 3B that tripped twice on the same day due to a cross-threaded mounting screw, which prevented proper tightening of the thermal element and resulted in localized overheating. The third failure involved a poor maintenance practice that caused an unacceptable axial offset of Auxiliary Component Cooling Water Pump B shaft. The pump was declared inoperable. The fourth failure dealt with an inadequate engineering analysis that provided an nonconservative plant operational restriction with respect to the Train A wet cooling tower basin.

All identified corrective actions for each of the four failures, with the exception of one, were completed. The corrective action, yet to be performed, consisted of replacing air-operated valve actuator seal rings and was generic to five air-operated valves in the auxiliary component cooling water system. These actions were scheduled for implementation during the upcoming refueling outage.

The goals for these problems were that no failures related to the identified causes would occur for 1 year from the date of completed corrective actions. The inspectors determined that appropriate monitoring had been established.

The inspectors noted the same inconsistency with respect to Maintenance Rule performance criteria between the System Engineer Maintenance Rule Notebook and the recovery plan for the component cooling water system. The system engineer acknowledged the inconsistency and stated that this would be evaluated and corrected.

The inspectors observed, and discussed with licensee personnel, that with the exception of one function, the system functions were broad based and did not quantify criteria or values for measuring functional capability. The inspectors noted that the System Engineer Maintenance Rule Notebook defined unavailability as when an auxiliary component cooling water pump was out-of-service or when a wet cooling tower did not meet the limiting conditions for operation specified in Technical Specification 3.7.4. Yet, the notebook defined a functional failure as any failure which could prevent a train from performing a defined system function. Similar to the component cooling water system, the inspectors believed that the notebook description had the potential for limiting or restricting the data used to determine unavailability.

As with the component cooling water system, the inspectors also observed conflicting guidance for trending unavailability. The inspectors noticed a similar inconsistency in application of the methodology of the unavailability data in the System Engineer Maintenance Rule Notebook. The auxiliary component cooling water system trend data matrix showed that the data was being trended on an hours per 2-year basis as opposed to an hours per year per unit and, consequently, the unavailability limits had been doubled.

Except for the issues regarding inconsistency in defining Maintenance Rule performance criteria and potential for limiting unavailability determination, the inspectors found that the goals and corrective actions were reasonable and commensurate with safety, and that the unavailability performance was adequately monitored.

c. Conclusions

c.1 Safety Consideration in Setting Goals and Performance Criteria

The inspectors concluded that there was a potential for failure to identify maintenance-preventable functional failures because structure, system, and component functions were only broadly defined. There was not a formal process to assure that system engineers performed needed reviews of changes to the Final

Safety Analysis Report, emergency operating procedures, and probabilistic safety analysis models. Additionally, the licensee's program did not address which available quantitative reference values to use for maintenance-preventable functional failure determinations. Finally, the failure to monitor the unavailability of functions associated with the engineered safety features actuation system, plant protection system, core protection calculators, broad range gas monitors, and containment polar crane was identified as a violation of 10 CFR 50.65 (a)(2) (50-382/9701-02).

c.2 Industry-Wide Operating Experience

The inspectors concluded that industry-wide operating experience was appropriately considered for the development of performance criteria, goals, and corrective actions to restore performance.

c.3 Monitoring and Trending

The inspectors concluded that the monitoring and trending program provided minimal support for ensuring unavailability was appropriately considered. The inspectors determined that this manipulation of trending data by discounting periods of high unavailability was a poor practice and could mask degrading performance.

c.4 Corrective Actions

For those systems in Category (a)(1), the goals established and the corrective actions implemented were adequate to restore structure, system, and component performance. As noted for systems in Category (a)(2), system functions were broad based and did not always quantify and provide criteria or parameter values for measuring functional performance. The performance criteria was not adequate to monitor the effectiveness of maintenance for the broad range gas monitors, and was identified as a violation of 10 CFR 50.65 (a)(2) (50-382/9701-02).

M2 Maintenance and Material Condition of Facilities and Equipment

a. Inspection Scope (62706)

In the course of verifying the implementation of the Maintenance Rule using Inspection Procedure 62706, the inspectors performed plant walkdowns to examine the material condition of the following systems:

- Auxiliary feedwater;
- Chilled water;
- Containment spray;
- Instrument air;
- Main steam;
- Low pressure safety injection;

- High pressure safety injection;
- 4160 volt electrical power distribution;
- Emergency feedwater;
- Cable vault and switchgear heating, ventilation, and air conditioning;
- Auxiliary component cooling water; and
- Component cooling water.

b. Observations and Findings

The inspectors generally found that the systems inspected appeared to be free of corrosion, fluid leaks, trash, and appeared, based on their external condition, to be sufficiently maintained. During the plant tours and system walkdowns the inspectors noted the following material condition issues and informed licensee representatives.

- A fluid leak on the floor adjacent to Charging Pump B was identified to an operations representative in the area.

- Water overflowing from the metal catch caps installed under Main Steam Safety Relief Valves MS-113A and -113B vent stacks was identified to an operations representative in the area.

- Heat exchanger piping for Instrument Air 1A Compressors A and B was corroded below Valves TC MVAAA230A and B.

c. Conclusions

For those systems and equipment that were inspected, material condition appeared good.

M7 Quality Assurance in Maintenance Activities

M7.1 Licensee Self Assessment

a. Inspection Scope (62706)

The inspectors reviewed the assessment that had been performed on licensee's Maintenance Rule Program from its inception to the time of the inspection.

b. Observations and Findings

The Nuclear Energy Institute had conducted a site-assist visit and issued the results in a letter dated January 23, 1996. This report contained mostly positive feedback regarding program development status, but did not provide any assessment.

The licensee's corporate organization conducted an assessment of the Waterford 3 Maintenance Rule Program implementation during the period of April 8-11, 1996. The assessment was thorough and provided the site Maintenance Rule organization with excellent findings, conclusions, and recommendations.

The licensee also engaged a third party to perform an independent assessment of Maintenance Rule implementation. This assessment was conducted August 5-9, 1996. This assessment was also thorough, assimilated individual findings into numerous programmatic deficiencies, and provided valid recommendations for addressing the identified deficiencies.

c. Conclusions

The inspectors concluded the scope of its corporate and third-party assessments was wide-ranging, the identification of issues was thorough, and meaningful feedback was provided to management.

M8 **Miscellaneous Maintenance Issues (62607)**

M8.1 (Closed) Unresolved Item 50-382/9611-02: adequacy of risk assessments performed for unscheduled switchyard maintenance performed in conjunction with the outage of Train B emergency core cooling and containment spray systems.

In NRC Inspection Report 50-382/9611-02, there were several procedural inadequacies discussed which affected risk evaluations associated with the performance of switchyard maintenance activities. The lack of procedural guidance had resulted in inconsistent applications of the on-line risk monitor for scheduling maintenance activities in the switchyard. The inconsistent application was that schedulers had arbitrarily assigned multipliers to the risk monitor for switchyard maintenance activities based on their knowledge and understanding of the electrical distribution system.

During this inspection, the inspectors determined that the licensee had developed an operations guide for using the risk monitor to control and evaluate planned and emergent switchyard activities and equipment problems. The quality of risk assessments had been enhanced by incorporating the impact of seasonal weather conditions (e.g., severe thunderstorm, tornado, or hurricane) on initiating events for loss-of-offsite power and reactor trip events. The operations guide contained reasonable guidelines for quantitative assessments of switchyard activities and provided guidance on actions to maintain reliability of offsite power to the plant. Strict guidance on actions to maintain reliability of offsite power included notifying the main control room from the switchyard control house to confirm the appropriate quantitative factors for risk monitor calculations prior to performing work on equipment associated with Bays 3 and 4, and the incoming power supply lines to the station. Appropriate operations personnel had received training on the use of the risk monitor.

On the basis of these observations, the inspectors concluded that the licensee had implemented procedures to ensure appropriate risk assessments are performed for certain switchyard and emergent work activities. Therefore, Unresolved Item 50-382/9611-02 is closed.

III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.3 Review of Updated Final Safety Analysis Report (UFSAR) Commitments

A recent discovery of a licensee operating their facility in a manner contrary to the UFSAR description highlighted the need for a special focussed review that compares plant practices, procedures and/or parameters to the UFSAR descriptions. While performing the inspections discussed in this report, the inspectors reviewed the applicable portions of the UFSAR that related to the areas inspected. The inspectors verified that the UFSAR wording was consistent with the observed plant practices, procedures and/or parameters.

E4 Engineering Staff Knowledge and Performance

E4.1 Engineer's Knowledge of Maintenance Rule

a. Inspection Scope (62706)

During discussions and interviews with system engineering personnel, the inspectors assessed individuals understanding of the integrated Maintenance Rule Program process and individual knowledge of their program-assigned responsibilities. The inspectors also reviewed the training that had been administered to system engineering personnel.

b. Observations and Findings

During interviews and discussions, system engineers exhibited a strong knowledge of their assigned systems. All were able to discuss current system health and performance problems.

Due to a lack of well defined functional boundaries, some engineers were not aware of system boundaries with respect to the Maintenance Rule Program. However, most of the system engineers had satisfactory knowledge of the Maintenance Rule Program as it applied to their assigned systems and were able to perform their specified duties. All system engineers contacted during the inspection were thoroughly familiar with their responsibilities in accordance with the licensee's procedural guidance. The system engineers displayed the ability to appropriately classify maintenance-preventable functional failures, develop goals, and develop corrective action for restoring performance. It was noted that a minority of

engineers could not articulate the difference between goals and performance criteria. Overall, system engineers were very involved in the system evaluations to determine assignment to Category (a)(1) or (a)(2).

Overall, system engineers had a good understanding of the integrated Maintenance Rule Program and knew the interfaces with the various support organizations. The inspectors reviewed available documentation and determined that all of the current system engineers had received approximately 1 day of training related to their Maintenance Rule responsibilities.

A majority of system engineers demonstrated an adequate knowledge of probabilistic risk assessment and the plant-specific individual plant examination to understand risk impact on their systems. A small fraction of the system engineers had only a minimum knowledge of probabilistic risk assessment. However, all had sufficient knowledge in this area to perform their assigned program responsibilities.

c. Conclusions

The knowledge and ability of the system engineers to perform their Maintenance Rule Program tasks were adequate. All system engineers exhibited strong knowledge of their assigned systems and performance-related conditions, and had a sufficient understanding of probabilistic risk assessment insight as it pertained to the Maintenance Rule.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors discussed the progress of the inspection on a daily basis and presented the inspection results to members of licensee management at the conclusion of the inspection on January 31, 1997. The licensee acknowledged the findings presented.

The inspectors asked the licensee staff and management whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

ATTACHMENT 1

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

R. Allen, Manager, Operational Experience Engineering
R. Azzarello, Manager, Maintenance
R. Burski, Director, Plant Modification and Construction
A. Cilluffa, Superintendent, Maintenance Engineering
G. Davie, Manager, Quality Assurance
F. Drummond, Director, Site Support
C. Dugger, Vice President, Nuclear Operations
M. Hanneman, Maintenance Rule Coordinator
J. Holman, Manager, Safety & Engineering Analysis Group
T. Gaudet, Manager, Licensing
D. Matheny, Manager, Operations
D. Shipman, Manager, Planning & Scheduling
D. Urciuoli, Licensing Engineer
D. Vinci, Manager, Plant Engineering
A. Wrape, Director, Design Engineering

NRC

T. Gwynn, Director, Division of Reactor Safety
L. Keller, Resident inspector
D. Powers, Chief, Maintenance Branch

INSPECTION PROCEDURES USED

IP 62706	Maintenance Rule
IP 62002	Inspection of Structures, Passive Components, and Civil Engineering Features at Nuclear Power Plants

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-382/9701-01	VIO	Failure to Include a Safety-Related System into the Program Scope
50-382/9701-02	VIO	Failure to Monitor the Unavailability of Five Risk Significant Structures, Systems, and Components

Closed

50-382/9611-02	URI	Assessment of Risk Associated With Switchyard Maintenance

LIST OF PROCEDURES REVIEWED

UNT-006-Q29	The Maintenance Rule, Revision 14
Engineering Guide 459020100	Maintenance Rule Engineering Guideline, Revision 1
Design Engineering Guide CIV-A-002	Maintenance Rule Structural Monitoring at Waterford 3, Revision 0
UNT-007-025	Plant Trending Program, Revision 3
UNT-004-035	Control of Vendor Information, Revision 5
ME-003-318	G.E. Undervoltage Relay Model 12IAV55C, Revision 7
OP-903-035	Containment Spray Pump Operability Check, Revision 8
AP PLG-009-007	Routine Scheduling of Station Activities, Revision 4
AP PLG-009-014	Conduct of Planned Outages, Revision 2
WF3 OPS GUIDE	Operations Guidelines on Use of EOOS Monitor

LIST OF DOCUMENTS REVIEWED

Design Basis Documents:

Electrical Distribution, Revision 1
W3-DBD-013, Containment Spray System, Revision 0
W3-DBD-020, Feedwater System, Revision 1
W3-DBD-037, Essential Chilled Water System, Revision 1

System Descriptions:

SD-4kV, 4.16kV Electrical Distribution System, Revision 1
SD-AFW, Feedwater System, Revision 2
SD-CHW, Essential Chilled Water, Revision 1
SD-CS, Containment Spray, Revision 1
SD-PPS, Plant Protection System, Revision 1
SD-CC, Component Cooling Water System, Revision 1

Calculations:

EC-S89-022, AC Power System, Revision 2
EC-S91-019, Safety Related Room Cooling, Revision 1
EC-S89-018, Power Conversion, Revision 2
EC-S89-020, Containment Spray, Revision 2

Condition Reports:

94-0658	94-0425	96-0827	96-0766
96-0729	96-1093	94-0425	96-1547
96-0868	93-0017	96-0801	

Vendor Technical Information Packages:

96175	96374	95488
94450	94228	95356

Other Documents Reviewed:

Waterford 3 Individual Plant Examination (IPE), August 1992
EOI Report, EOI Maintenance Rule Implementation Assessment, June 19, 1997
Company Policy PL-130, "Online Maintenance Philosophy," Revision 2
Nuclear Energy Institute Letter, January 23, 1996
EOI Waterford-3 Maintenance Rule Implementation Assessment, April 16, 1996
Waterford-3 Maintenance Rule Implementation Independent Assessment, August 9, 1996
Waterford 3 Scheduling Guide, "Daily Scheduling Information Guide Notebook"